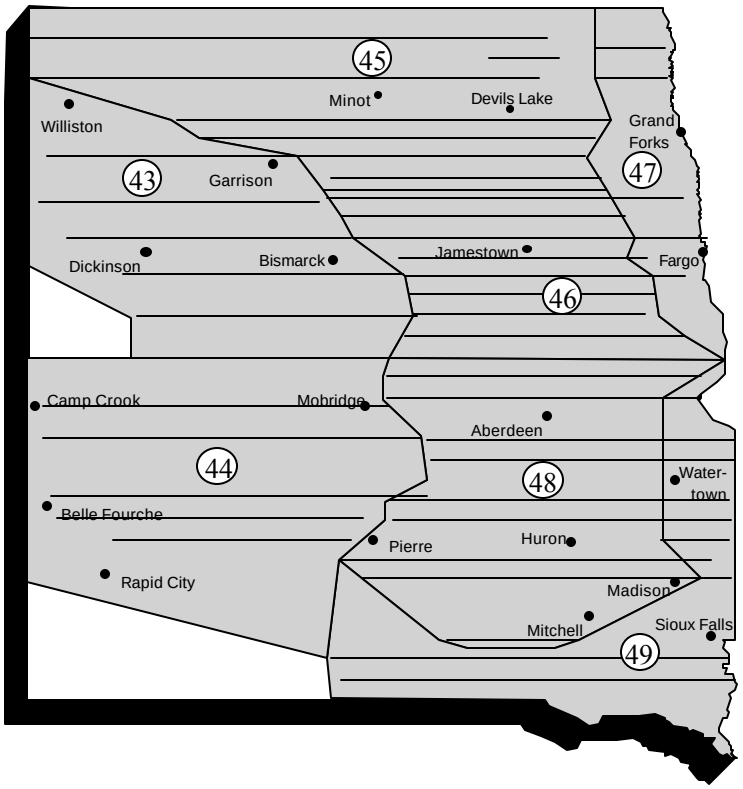
2002

WATERFOWL BREEDING POPULATION SURVEY

FOR

SOUTH DAKOTA AND NORTH DAKOTA



U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

TITLE: Waterfowl Breeding Population and Habitat Survey for South and North Dakota

STRATA SURVEYED: 44, 48, 49 (South Dakota)
43, 45, 46, 47 (North Dakota)

DATES: 2 - 5 May 2002 (43 and 44)
12 - 29 May 2002 (45, 46, 47, 48, and 49)

DATA SUPPLIED BY: United States Fish and Wildlife Service

Strata 45, 46, 47, 48, 49

Aerial Crew
Observer/Pilot - John W. Solberg, Flyway Biologist, WPS/DMBM, Bismarck, ND

Observer - Sue Thomas, Wildlife Biologist, MBSP, R-1, Portland, OR

Ground Crew
Leader - George Allen, Wildlife Biologist, BSA/DMBM, Arlington, VA

Assistants -
Pam Garrettson, Wildlife Biologist, PHAS/DMBM, Laurel, MD
Tim Menard, Wildlife Biologist, Flint Hills NWR, Hartford, KS
Fritz Prellwitz, Wildlife Biologist, Bowdoin NWR, Malta, MT

Strata 43 and 44

Aerial Crew
Observer/Pilot - James F. Voelzer, Chief - WPS/DMBM, Portland, OR

Observer - Ray Bentley, Flyway Biologist, WPS/DMBM, Corvallis, OR

Ground Crew
Leader - Allison Arnold, Wildlife Biologist, EPIC, LLC, Dripping Springs, TX

Assistants - Sara Mc Fall, Biological Technician, Ridgefield NWR, Ridgefield, WA

ABSTRACT: The 2002 Waterfowl Breeding Ground and Habitat Survey for Eastern South and North Dakota was conducted 12 - 29 May with standard aerial coverage. East river personnel changes occurred this year only in the ground crew. Habitat conditions in the crew area deteriorated since the spring of 2001 and ranged from poor to good. Residual upland nesting

cover was generally adequate but over water nesting sites have been reduced due to diminished water conditions. Temporary and seasonal wetland basins were essentially dry and most semi-permanent basins were in some stage of recession. Compared to 2001, wetland counts decreased 56% in South Dakota and -9% in North Dakota. The estimated waterfowl breeding population in South Dakota (2.765 million) was 12th highest of record and lowest since 1993. In North Dakota, the waterfowl breeding population (4.568 million) was 8th highest of record and posted its lowest level since 1994. The outlook for waterfowl production for the overall region in 2002 is near average.

Selected information for 2002 is presented below:

South Dakota

	2002 Indices (thousands)	Percent Change From 2001	Percent Change From 1992-2001 mean	Percent Change From 1959-2001 mean
Mallard	699.3	-33%	-21%	49%
Gadwall	441.6	-13%	-11%	96%
Blue-winged Teal	1043.1	-35%	-22%	24%
Northern Pintail	88.1	-77%	-63%	-61%
Redhead	75.6	48%	26%	60%
Canvasback	7.8	55%	14%	24%
Total Ducks	2764.9	-36%	-22%	28%
May Ponds	433.9	-56%	-45%	-20%

North Dakota

	2002 Indices (thousands)	Percent Change From 2001	Percent Change From 1992-2001 mean	Percent Change From 1959-2001 mean
Mallard	1247.7	-16%	14%	113%
Gadwall	691.5	-11%	-7%	92%
Blue-winged Teal	1338.3	-21%	-10%	56%
Northern Pintail	227.7	-40%	-29%	-34%
Redhead	143.5	-37%	-33%	5%
Canvasback	32.5	-51%	-26%	9%
Total Ducks	4568.4	-21%	-4%	61%
May Ponds	682.5	-9%	-26%	-6%

METHODS: The procedures followed in conducting the survey are described in the Standard Operating Procedures for Aerial Breeding Ground and Habitat Surveys in North America, Section III, revised 1987. There were no changes in survey coverage and all transects were flown (Tables 3 and 6).
Personnel changes in 2002 included only one ground crewmember. Tim Menard, a wildlife biologist from Flint Hills NWR in Kansas, joined the east river ground crew this year.

Remaining air and ground personnel were unchanged since 2001. All members participated in pre-survey training/review sessions relating to air and ground procedures. Participants were critiqued regarding species identification, judgement of transect width, and adherence to standard operating procedures.

Visibility Correction Factors (VCFs) in the crew area are typically calculated using observations collected from 17 air/ground comparison segments. All comparison segments in the crew area are co-located with operational survey segments, and this year all were completed. The VCF for wetlands, established by comparison of air and ground observations, was 1.22. Wetland counts and all other data are considered comparable to all years when VCF's were determined.

Transect flying was accomplished in a wheeled Cessna 185. The survey required about 70 hours of flight time including aerial observer review, reconnaissance, and the collection of footage for several video productions. Aerial crews continued to utilize on-board computers, interfaced with the aircraft GPS, to capture georeferenced waterfowl and wetland observations. Aerial sampling commenced 12 May in the eastern Dakotas and ground counts were completed on the 30th. Once the survey was initiated, 4 days were forfeited to adverse weather. The common culprit again this year was wind, which exceeded 50 mph on numerous occasions. Information from Stratum 43 and 44 was collected 2 - 5 May by the Montana survey crew led by James Voelzer. Our appreciation is extended to that crew for their efforts and contributions of data and habitat information from the Western Dakotas.

WEATHER AND HABITAT CONDITIONS:

The crew area entered the fall of 2001 with the western portions considered abnormally dry. Hot, dry conditions during the first two weeks of September further reduced soil moisture levels in both states. Temperatures dropped to below normal during the later half of September and October with windy conditions prevailing. East of the Missouri river, the crew area received average to above average precipitation as fall progressed. West of the river, the area experienced lower than normal precipitation with windy conditions further reducing the soil moisture conditions. These conditions abated somewhat in the Dakotas during October with normal precipitation occurring in the eastern portion of North Dakota and the eastern and central portions of South Dakota.

Warmer than average temperatures returned to the crew area during the first half of November with dry conditions throughout. The last week of November ushered in several seasonal storms easing dry conditions, although areas west of the river remained abnormally dry and the extreme western portion of North Dakota was in the first stage of drought. By the end of November, the majority of the crew area received some snow cover; however the area had experienced a milder than average winter thus far.

Mild temperatures and dry conditions continued into December with little snow cover overall (state averages of 3.3" in North Dakota and 1.8" in South Dakota). Drought indices remained the same as in November. Mild, dry conditions continued into January with minimal snow cover. The jet stream dipped further south during the later half of the month allowing colder

temperatures to move in from the north, particularly in North Dakota. Dry conditions remained throughout resulting in abnormally dry conditions expanding east of the river. The winter period of November through January was one of the mildest on record for both states.

By February, the entire crew area was considered abnormally dry with the extreme western border in the first stages of drought. The trend of mild dry conditions prevailed again through February. Average snow cover for both states was reported as 0.6". As in January, the jet stream dipped south into the states, allowing arctic cold air to move into North Dakota during the last few days of February; however, temperatures were generally mild for the rest of the month.

March brought a return to the normal cold conditions of winter. Temperatures were on average 10-15 degrees below normal for both states. Scattered snow storms brought much-needed moisture to South Dakota; however, conditions in North Dakota remained dry. Drought indices remained the same as in February: abnormally dry to the first stages of drought. Seasonably unsettled conditions prevailed throughout the Dakotas during April. Several fronts moved through the crew area, continually modulating temperatures. Overall, scattered rain and snow showers were reported; however, precipitation was again below average.

May weather in the Dakotas continued unseasonably cool. In fact, during the second week of the month, winter returned. Some areas of western South Dakota and western, central, and northern North Dakota received 5" - 10" of snow. Although temperatures reached near normal during the last week of May, monthly averages were 5° to 15° below normal. Nearly the entire region received below normal precipitation during May, and at month's end, the annual precipitation deficit continued. The lack of precipitation continued to deplete surface and sub-surface moisture. At the end of May, the western three-quarters of both states were considered abnormally dry or in moderate drought condition.

At survey initiation, habitat conditions looked more like late winter than spring. Because of low soil moisture and cool temperatures, vegetation development was extremely late. By the third week of May, leaf buds on many trees had not opened and cool season grass species were just beginning to "green up." Warm season grasses showed no response to the "spring" conditions by the end of our survey. Residual cover in the upland areas was generally in adequate supply. Upland cover showed little evidence of matting by winter snow and stood erect for nesting waterfowl. Residual emergent vegetation, particularly around the perimeter of receded semi-permanent wetlands, provided little benefit as escape or nesting cover. The dry conditions around the margins of semi-permanent basins allowed for more burning and encroachment by agriculture than we've witnessed since 1993. Tilling and planting of temporary and seasonal wetland basins was also common this year.

In the crew area, wetland conditions were drastically different than those observed during the 1994 - 1999 period. The most striking change this year was the absence of temporary and seasonal water and the recessional stages of most semi-permanent basins. Although the drier conditions of 2002 are allowing negative impacts by agriculture, these basins have been wet for a good period of time and probably need to dry out and revitalize. This year was a "reality check" in prairie wetland dynamics and when coupled with the dry conditions in much of prairie Canada, probably "sets the stage" for a major overflight of the prairies by breeding waterfowl.

In South Dakota, the total wetland index decreased 56% since 2001, and 45% and 20% compared to the respective ten-year and long-term averages (Table 2). In North Dakota, the statewide wetland count was similar to last year (-9%) and the long-term average (-6%), but below (-26%) the ten-year mean (Table 5). These decreases (particularly compared to the ten-year average) result primarily from the absence of seasonal wetlands, which are included in our counts. Descriptions by stratum are listed below.

SOUTH DAKOTA (St. 44: 2 - 3 May, St. 48, 49: 12 -18 May)

Stratum 44 -Wetland counts in the stratum decreased 18% compared to last year and 58% and 44% compared to ten-year and long-term averages. The west river crew reported that "larger ponds and stock dams contained adequate water, although depleted water levels were the rule; generally three quarters full." Residual nesting cover was rated below average. The overall season was considerably later developing than any in recent memory. Normal to below production is expected.

Stratum 48 - Compared to 2001, wetland counts in the stratum decreased 64%. The 2002 index reflects a 49% and 20% decreases compared to the ten-year and long-term averages. The majority of habitat conditions in the stratum were considered fair with the western portion of the Prairie Coteau and the southern portion of the Missouri Couteau considered good. To reiterate, wetlands in the areas considered good were not necessarily in better condition than those in the fair areas, but the density of semi-permanent and permanent basins is higher than in the areas classed as fair. These were the only wetland complexes available this year. Below average waterfowl production is expected from the stratum this year.

Stratum 49 - A small area in the extreme south eastern portion of Stratum 49 was the only region in the crew area exhibiting any appreciable temporary/seasonal water. Despite the fact that this region of 49 is intensively impacted by agriculture and nesting cover here is at a premium, we considered these habitat conditions good. The eastern portion of the Prairie Coteau was also considered good, again for the combination of upland nesting cover and higher densities of semi-permanent and permanent wetlands. The remainder of the stratum was considered fair nesting habitat. The 2002 wetland index in Stratum 49 decreased compared to 2001 (-55%) and the ten-year average (-23%), but was similar to (6%) the long-term mean. Waterfowl production is expected to be average or slightly below.

NORTH DAKOTA (St. 43: 3 - 4 May, St. 45, 46, 47: 19 - 29 May)

Stratum 43 - As reported by the west river crew, Stratum 43 was the only stratum posting an increase (12%) in wetland numbers since May 2001. Conditions were drier this year compared to the ten-year mean (-34%) and the long-term average (-16%). Residual nesting cover was considered below average. Overall habitat conditions were deemed poor in the west, fair in the southeast, and good in central portions of the stratum. Production is expected to be below average due to the loss of early nesting and crowding on remaining wetlands.

Stratum 45 - Portions of the Missouri Coteau and localized areas near Devils Lake were

considered good. Areas in Bottineau, Renville, Williams, and Mountrail counties in the north central and north west were classed as poor. The remainder of the stratum was placed in the fair habitat category. Wetland counts diminished 10% compared to 2001 and the ten-year average (-18%) but were similar to (-4%) the long-term average. Near average production is expected from the stratum.

Stratum 46 - The 2002 wetland index in 46 was similar to the long-term average (-2%). Compared to last year and the ten-year average, the 2002 figure was 13% and 31% lower. General habitat conditions were considered good in the Missouri Coteau and a localized area east of Jamestown. The remainder of the stratum was considered fair. Average or slightly better production is expected from Stratum 46.

Stratum 47 - Conditions were extremely dry in the northern third of the Red River Valley and the habitat considered poor. In the southern two-thirds, water conditions were relatively better and habitat conditions were considered fair. As always, farming intensity in this region provided little nesting cover for breeding waterfowl. Water counts in the stratum were lower this year compared to: 2001 (-26%), the ten-year (-43%), and the long-term (-24%) average. Lower than average waterfowl production is expected from Stratum 47.

DISCUSSION/BREEDING POPULATION ESTIMATES: The crew arrived in south eastern South Dakota on 5 May. Following three days of assessing waterfowl migration and habitat, the decision was made to delay survey initiation for 1 week. Reconnaissance revealed that especially gadwalls and blue-winged teal were in migratory flocks and were not completely settled onto nesting territories. Cold weather, winter-like storms, and limited precipitation continued until the 11th. When the unsettled weather ended, the Saskatchewan survey crew indicated that gadwall and blue-winged teal had arrived in their survey unit.

Aerial and ground survey was initiated in southeastern South Dakota on 5/12. At this time, appropriate species were present and in what we considered normal behavior and social groupings for the habitat conditions and date. Drake to pair ratios for mallards were about 50:50 for both states. Drake to pair ratios for pintails in North Dakota were similar to mallards, but suggest that in South Dakota (80:38), nesting pintails may have been a bit further along or non-breeding due to the dry conditions. We feel that our survey timing was acceptable. With the absence of water in temporary and seasonal basins, invertebrate production from “early” water was lacking and breeding birds were forced to concentrate on semi-permanent, permanent, and man-made wetlands. Birds were crowded to some extent throughout the crew area but the situation was most pronounced in the northwest corner of North Dakota near the Saskatchewan border. Our ability to detect birds was improved this year, particularly on the receded semi-permanent wetlands, where perimeter vegetation was unavailable as cover to birds on the water. The somewhat crowded conditions has removed much of the visual separation for pairs and will concentrate nesting areas to some extent. Of course these concentrations will increase the efficiency of nest predators.

In South Dakota, the 12th highest breeding population index of record (2.765 million) was observed (Appendix 1). The 2002 total duck index decreased 36% compared to last year and 22% compared to the ten-year average but remained above (28%) the long-term mean (Table 1).

Mallards fell below one million birds for the first time since 1996 and dropped 33% since last year, yet remain 49% above the long-term average. Responding to the lack of temporary and seasonal water, all species of dabbling ducks decreased compared to last year and the ten-year average. Most remained near or above long-term figures. The exceptions were Northern Pintail (-61%) and American Wigeon (-17%) which decreased significantly compared to their long-term averages. Diving ducks in South Dakota fared better than dabblers, probably due to good water conditions in the permanent wetlands.

The total index for breeding waterfowl in North Dakota in 2002 was 4.568 million birds (Appendix 2). The 2002 figure represents the 8th highest breeding population of record. Total ducks decreased 21% since 2001, was similar to (-4%) the ten-year average, and was well above (61%) the long-term average (Table 4). Mallards in North Dakota decreased 16% since 2001 but were above the million mark for the eighth year running. The 2002 mallard index remained above both the ten-year (14%) and long-term (113%) averages. Compared to long-term averages, most species of dabblers remained well above those historic levels. Again, the exception was the Northern Pintail, which was 34% below the long-term mean. North Dakota diving ducks were generally similar to or decreased from 2002 levels, except ring-necked ducks (73%). All species of divers were similar to or well above long-term averages.

CONCLUSIONS:

1. A relatively mild and dry winter was followed by a late, cold spring in both states. Wetland counts decreased in South Dakota compared to 2001 (-56%), the ten-year average (-45%), and the long-term average (-20%). In North Dakota, wetlands were similar in number compared to 2001 (-9%) and the long-term average (-6%) but were below (-26%) the long-term figure. Temporary and seasonal wetlands were nearly non-existent in the crew area. Residual upland cover was in adequate supply but current year vegetation development was much retarded due to the lack of moisture and warm temperatures. Emergent vegetation, too, was slow to respond and residual emergents, particularly in semi-permanent wetlands, will offer little benefit to nesting ducks. Negative impacts by agriculture are occurring to dry basins.

2. Early nesting waterfowl species arrived on their breeding grounds slightly later than last year and mid- and late-nesting species were much later to arrive and settle. Decreases in wetland numbers since last year have concentrated breeding birds and nesting areas. The reduction of wetland areas reduced early invertebrate production, probably lowered body condition of nesting hens, will increase nest predation, and lower brood survival. Numbers of breeding waterfowl in South Dakota (2.765 million) decreased 36% since 2001 but is 28% above the long-term average. Mallards also decreased since last year (-33%) but remained above the long-term level (49%). In North Dakota, breeding waterfowl (4.568 million) decreased 21% since last year but are 61% above long-term levels. Mallards in North Dakota decreased slightly (-16%) since 2001 but again, were 113% above the long-term mean. Following the trend of temporary and seasonal water, Northern Pintails decreased dramatically in both states compared to the three time

comparisons. Although breeding populations in the Dakotas remain above long-term averages, when considered with wetland indices near or below long-term levels, we anticipate waterfowl production in 2002 to be average to below average in South Dakota and average to above average in North Dakota.

John W. Solberg and Sue Thomas
July 2002

Table 1. Status of waterfowl breeding population estimates (thousands, adjusted for visibility bias) by species and stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1959) for South Dakota.

	Stratum							% Change From		
Species/Ponds	44	48	49	2002 Total	2001 Total	10-Year Mean	Long-Term Mean	2001	10-Year Mean	Long-Term Mean
Ducks										
Dabblers										
Mallard	119.2	410.9	169.2	699.3	1040.5	885.1	470.0	-32.8%	-21.0%	48.8%
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	-100.0%
Gadwall	50.2	316.5	74.9	441.6	508.9	497.5	225.3	-13.2%	-11.2%	96.0%
Am. wigeon	8.8	19.9	4.4	33.0	53.5	54.7	39.7	-38.3%	-39.6%	-16.8%
Am. green-winged teal	17.7	6.6	3.9	28.2	69.8	46.0	29.8	-59.6%	-38.7%	-5.2%
Blue-winged teal	95.5	638.4	309.2	1043.1	1608.7	1336.0	837.7	-35.2%	-21.9%	24.5%
N. shoveler	16.9	135.7	35.7	188.3	461.9	293.4	191.5	-59.2%	-35.8%	-1.7%
N. pintail	25.6	44.6	17.8	88.1	385.4	235.7	223.8	-77.1%	-62.6%	-60.6%
Subtotal	333.9	1572.6	615.1	2521.6	4128.7	3348.4	2017.7	-38.9%	-24.7%	25.0%
Divers										
Redhead	1.7	51.6	22.4	75.6	51.0	59.9	47.4	48.4%	26.3%	59.7%
Canvasback	2.3	4.1	1.5	7.8	5.1	6.9	6.3	54.9%	13.5%	23.8%
Scaups	10.5	45.6	10.4	66.6	44.5	73.3	43.4	49.5%	-9.2%	53.2%
Ring-necked duck	0.3	9.2	3.8	13.3	8.7	17.6	8.2	53.1%	-24.5%	62.6%
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.2	0.3	--	-100.0%	-100.0%
Bufflehead	0.0	1.9	0.0	1.9	0.6	3.2	1.5	211.9%	-39.9%	25.8%
Ruddy Duck	0.0	68.7	7.0	75.6	58.8	37.0	31.5	28.5%	104.2%	139.9%
Subtotal	14.8	181.0	45.0	240.9	168.7	198.2	138.7	42.8%	21.6%	73.7%
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Scoters	0.0	0.0	0.0	0.0	0.0	0.2	0.0	--	-100.0%	-100.0%
Mergansers	2.4	0.0	0.0	2.4	3.7	3.2	1.6	-35.0%	-25.0%	51.1%
Subtotal	2.4	0.0	0.0	2.4	3.7	3.4	1.6	-35.0%	-28.6%	47.6%
Total Ducks	351.1	1753.7	660.2	2764.9	4301.1	3549.9	2158.1	-35.7%	-22.1%	28.1%
Canada Goose	20.1	53.5	15.1	88.7	169.9	89.6	29.5	-47.8%	-0.9%	200.5%
Am. coot	0.7	142.8	91.6	235.1	141.7	353.4	201.3	65.9%	-33.5%	16.8%
Ponds	85.9	204.1	143.8	433.9	989.1	789.5	543.4	-56.1%	-45.0%	-20.2%

Table 2. Long-term trend in adjusted May pond estimates (thousands) by stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1974) for South Dakota. Estimates prior to 1974 were not adjusted for visibility bias.

	Stratum			
Year	44	48	49	Total
1961	33.1	48.1	34.2	115.4
1962	69.5	152.3	95.7	317.4
1963	80.2	142.2	106.9	329.3
1964	62.0	79.3	56.8	198.0
1965	84.5	100.3	53.0	237.8
1966	94.5	143.6	79.7	317.8
1967	90.2	132.4	66.5	289.0
1968	71.8	146.0	61.1	278.9
1969	156.5	263.5	111.6	531.6
1970	161.3	183.3	58.9	403.4
1971	146.4	132.7	85.4	364.4
1972	205.5	263.8	108.1	577.4
1973	153.4	126.1	82.4	362.0
1974	68.0	186.0	125.4	379.4
1975	151.0	236.4	108.3	495.7
1976	92.9	121.8	93.1	307.8
1977	84.7	114.5	73.0	272.3
1978	212.3	307.4	131.5	651.2
1979	82.0	214.6	148.6	445.3
1980	66.8	108.4	88.3	263.5
1981	64.3	58.8	40.0	163.0
1982	148.1	176.7	73.7	398.4
1983	104.3	189.4	142.6	436.4
1984	142.8	262.4	189.4	594.6
1985	116.7	183.8	124.4	425.0
1986	216.7	260.5	132.2	609.4
1987	194.9	216.4	105.9	517.3
1988	92.5	99.9	114.4	306.8
1989	195.4	222.0	86.7	504.1
1990	124.0	79.4	56.7	260.0
1991	106.5	113.1	69.5	289.1
1992	107.5	96.8	61.6	265.8
1993	141.1	334.7	225.0	700.7
1994	281.1	356.5	180.9	818.4
1995	279.4	458.2	195.9	933.4
1996	324.4	418.2	172.2	914.8
1997	278.8	478.8	167.5	925.1
1998	195.3	337.8	162.0	695.1
1999	157.4	618.1	249.4	1025.0
2000	161.3	324.7	141.6	627.6
2001	105.3	562.9	320.9	989.1
2002	85.9	204.1	143.8	433.9
10-year Mean	203.2	398.7	187.7	789.5
Long-term Mean	153.4	254.9	135.0	543.4
Percent Change:				
From 2001	-18.4%	-63.7%	-55.2%	-56.1%
From 10-year Mean	-57.7%	-48.8%	-23.4%	-45.0%
From Long-term Mean	-44.0%	-19.9%	6.5%	-20.2%

Table 3. Survey design for South Dakota, May 2002.

	Stratum			
	44	48	49	Total
Survey design				
Square miles in stratum	27,299	24,587	15,830	67,716
Square miles in sample	216	315	171	702
Linear miles in sample	864	1,260	684	2,808
Number of transects in sample	5	9	11	25
Number of segments in sample	48	70	38	156
Expansion factor	126.3842	78.05396	92.57309	---
Current year coverage				
Square miles in sample	216	315	171	702
Linear miles in sample	864	1,260	684	2,808
Number of transects in sample	5	9	11	25
Number of segments in sample	48	70	38	156
Expansion factor	126.3842	78.05396	92.57309	---

Appendix 1. Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Ducks										
Dabblers										
Mallard	108.2	176.6	212.1	367.3	535.8	261.1	314.5	216.3	248.2	450.7
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	0.0	9.9	18.9	73.9	164.0	53.6	115.4	112.9	75.1	197.8
Am. wigeon	7.1	9.6	6.1	8.1	3.1	4.4	0.0	9.6	29.7	22.6
Am. green-winged teal	0.0	0.0	2.7	10.0	2.7	0.0	0.0	7.7	9.6	23.5
Blue-winged teal	413.1	524.5	673.8	602.5	1201.5	686.3	703.6	623.9	313.7	466.1
N. shoveler	38.4	156.3	96.4	335.5	225.4	95.7	90.2	108.3	82.2	150.6
N. pintail	25.5	305.7	175.4	557.8	221.6	108.8	128.9	228.9	186.6	129.1
Subtotal	592.3	1182.5	1185.3	1955.1	2354.1	1209.9	1352.6	1307.7	945.1	1440.2
Divers										
Redhead	0.0	30.1	14.3	56.4	50.5	50.4	56.4	56.7	20.1	33.4
Canvasback	2.8	1.4	2.8	2.2	2.6	5.0	2.0	6.1	3.5	2.6
Scaups	13.6	18.3	8.1	32.9	11.0	1.4	29.2	29.7	11.2	22.3
Ring-necked duck	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.4	1.1	0.0
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bufflehead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.9	0.0
Ruddy Duck	0.0	10.7	3.6	11.8	5.6	1.4	1.9	5.6	0.0	8.9
Subtotal	16.4	60.5	28.8	103.4	70.7	58.1	89.5	100.0	36.8	67.2
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Subtotal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Total Ducks	608.7	1243.0	1214.2	2058.5	2424.9	1268.1	1442.0	1409.0	982.0	1507.4
Canada Goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.9	0.0
Am. coot	31.1	40.4	29.3	61.0	21.0	53.4	19.3	33.8	28.0	75.7
Ponds										

Species/Ponds	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Ducks										
Dabblers										
Mallard	443.3	415.2	392.0	493.0	432.6	276.5	354.3	256.2	186.8	537.3
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	243.8	214.5	162.2	192.1	149.9	85.5	126.4	44.6	31.4	233.6
Am. wigeon	30.7	21.4	19.0	99.1	43.7	16.3	42.7	56.6	29.2	92.7
Am. green-winged teal	29.0	115.1	25.4	42.6	29.6	19.1	37.4	31.1	9.8	38.5
Blue-winged teal	742.2	706.8	654.3	1209.0	777.1	348.8	437.2	351.7	318.9	1287.3
N. shoveler	195.7	260.3	103.2	330.9	110.6	51.1	92.9	56.5	58.6	419.1
N. pintail	396.6	333.3	247.8	395.4	275.1	99.1	218.2	111.7	130.8	678.4
Subtotal	2081.2	2066.8	1603.9	2762.1	1818.6	896.5	1309.0	908.4	765.5	3287.0
Divers										
Redhead	87.8	53.6	60.7	48.6	34.6	20.2	27.3	4.1	10.8	144.4
Canvasback	17.9	6.1	2.8	14.2	13.1	6.4	5.6	3.1	3.0	12.3
Scaups	12.1	74.4	7.3	41.1	19.2	13.0	12.7	45.3	16.4	73.7
Ring-necked duck	0.0	1.1	0.5	0.0	0.0	0.0	0.0	0.3	0.4	1.4
Goldeneyes	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	1.0
Bufflehead	0.0	0.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	0.5
Ruddy Duck	7.0	39.3	27.7	30.1	18.6	23.2	209.7	6.2	5.8	28.7
Subtotal	124.8	174.5	99.0	136.6	85.5	63.2	255.4	59.0	36.4	261.9
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Subtotal	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
Total Ducks	2206.0	2241.2	1702.9	2898.7	1904.9	959.7	1564.4	967.4	801.9	3548.9
Canada Goose	8.2	0.9	2.1	3.4	6.4	3.7	1.9	3.0	1.8	7.2
Am. coot	91.1	91.8	35.0	110.9	126.1	27.8	75.7	66.6	91.4	232.5
Ponds						379.4	495.7	307.8	272.3	651.2

Appendix 1 (continued). Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Ducks										
Dabblers										
Mallard	441.7	338.9	186.8	291.7	314.9	334.9	310.1	532.0	556.8	374.1
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	136.7	69.8	113.6	189.1	219.0	263.7	145.5	254.3	205.7	222.5
Am. wigeon	33.6	41.5	60.0	40.7	73.8	87.0	45.2	39.7	45.6	48.8
Am. green-winged teal	19.3	70.2	21.1	34.9	36.6	22.0	31.6	52.1	23.4	25.5
Blue-winged teal	906.0	483.3	254.1	519.9	801.8	938.8	604.5	1433.5	777.1	617.1
N. shoveler	341.8	59.3	66.7	152.4	200.0	236.9	113.2	379.8	226.9	84.4
N. pintail	280.0	119.7	53.0	204.2	223.8	263.5	165.3	389.5	212.8	118.4
Subtotal	2159.0	1182.6	755.3	1432.9	1869.9	2146.9	1415.3	3080.8	2048.2	1490.9
Divers										
Redhead	50.9	28.2	22.0	45.2	82.9	111.9	35.9	64.2	34.1	19.3
Canvasback	5.6	8.0	5.9	2.2	2.3	15.8	4.6	11.5	5.7	7.6
Scaups	36.7	5.4	19.1	43.7	54.3	58.6	30.6	104.7	35.4	63.2
Ring-necked duck	0.6	1.2	2.8	7.1	59.0	17.3	1.4	18.3	14.4	5.7
Goldeneyes	0.0	0.0	0.0	1.2	2.4	0.8	0.8	0.8	0.0	0.0
Bufflehead	1.5	1.1	0.9	3.1	6.1	2.8	0.0	4.8	0.0	2.9
Ruddy Duck	16.0	21.6	67.0	84.4	88.9	48.7	23.1	69.4	28.5	3.2
Subtotal	111.3	65.5	117.8	187.0	295.9	255.8	96.5	273.6	118.1	101.8
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	2.5	0.8	0.0	7.0	5.7	6.1	0.0	0.0	0.0	2.1
Subtotal	2.5	0.8	0.0	7.0	5.7	6.1	0.0	0.0	0.0	2.1
Total Ducks	2272.9	1248.9	873.1	1626.9	2171.4	2408.9	1511.8	3354.5	2166.3	1594.7
Canada Goose	4.8	3.4	9.8	23.9	13.0	19.0	15.2	12.5	17.6	57.2
Am. coot	356.1	77.1	176.8	202.7	263.5	603.7	196.5	487.5	427.3	436.4
Ponds	445.3	263.5	163.0	398.4	436.4	594.6	425.0	609.4	517.3	306.8

Species/Ponds	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Ducks										
Dabblers										
Mallard	472.0	183.5	342.6	360.6	491.5	715.9	919.7	839.8	1323.2	1035.6
Am. black duck	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	177.7	125.7	282.9	281.5	246.6	383.0	541.5	451.8	819.5	624.2
Am. wigeon	21.6	27.4	44.4	32.9	17.3	83.6	46.8	47.6	71.3	74.6
Am. green-winged teal	24.4	8.5	17.0	12.6	6.6	55.2	58.4	63.0	69.4	34.3
Blue-winged teal	860.2	346.3	1075.4	626.4	679.9	1383.6	1468.4	1390.9	1535.0	1573.4
N. shoveler	185.4	79.2	117.2	102.0	213.4	283.5	350.0	287.6	414.3	230.3
N. pintail	148.3	63.4	69.8	65.7	166.7	230.1	364.2	187.3	349.9	205.4
Subtotal	1889.5	834.3	1949.3	1481.8	1821.9	3134.8	3749.0	3268.0	4582.7	3777.8
Divers										
Redhead	55.1	16.7	11.7	41.0	62.4	98.2	68.4	54.3	55.6	78.9
Canvasback	5.3	8.1	5.3	1.4	8.0	14.6	7.6	9.1	9.2	4.5
Scaups	80.4	43.5	66.8	47.9	7.3	155.2	120.9	94.6	75.6	87.4
Ring-necked duck	17.7	17.6	5.5	27.6	5.8	11.1	41.6	17.4	19.1	8.4
Goldeneyes	0.0	0.0	3.6	0.0	0.0	0.8	0.8	0.9	0.0	0.0
Bufflehead	5.0	0.5	1.2	7.5	0.0	12.0	5.9	1.2	1.3	0.6
Ruddy Duck	44.0	34.1	10.2	3.9	21.5	36.7	43.2	14.7	18.7	24.9
Subtotal	207.6	120.5	104.2	129.3	105.0	328.7	288.4	192.1	179.5	204.8
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	3.5	2.4	4.0	0.0	2.1	3.7	4.9	0.5	7.7	2.5
Subtotal	3.5	2.4	4.0	1.6	2.1	3.7	4.9	0.5	7.7	2.5
Total Ducks	2100.5	957.3	2057.5	1612.7	1929.1	3467.2	4042.3	3460.6	4769.9	3985.1
Canada Goose	65.4	46.2	44.2	48.6	37.7	46.5	55.9	73.5	86.8	99.8
Am. coot	284.7	191.5	77.4	132.8	167.2	311.0	616.9	409.9	525.7	469.0
Ponds	504.1	260.0	289.1	265.8	700.7	818.4	933.4	914.8	925.1	695.1

Appendix 1 (continued). Long –term trend in adjusted waterfowl breeding population estimates (thousands) in South Dakota.

Species/Ponds	1999	2000	2001	2002
Ducks				
Dabblers				
Mallard	1016.4	1108.4	1040.5	699.3
Am. black duck	0.0	0.0	0.0	0
Gadwall	481.6	636.2	508.9	441.6
Am. wigeon	49.1	69.9	53.5	33
Am. green-winged teal	39.1	51.6	69.8	28.2
Blue-winged teal	1516.6	1576.9	1608.7	1043.1
N. shoveler	364.3	226.8	461.9	188.3
N. pintail	201.9	200.5	385.4	88.1
Subtotal	3669.0	3870.3	4128.7	2521.6
Divers				
Redhead	56.0	33.0	51.0	75.6
Canvasback	2.9	6.7	5.1	7.8
Scaups	40.3	59.1	44.5	66.6
Ring-necked duck	25.7	10.8	8.7	13.3
Goldeneyes	0.0	0.0	0.0	0
Bufflehead	2.3	0.4	0.6	1.9
Ruddy Duck	82.1	65.9	58.8	75.6
Subtotal	209.4	175.9	168.7	240.9
Miscellaneous				
Long-tailed duck	0.0	0.0	0.0	0
Eiders	0.0	0.0	0.0	0
Scoters	0.0	0.0	0.0	0
Mergansers	4.0	2.9	3.7	2.4
Subtotal	4.0	2.9	3.7	2.4
Total Ducks	3882.5	4049.1	4301.1	2764.9
Canada Goose	111.8	165.3	169.9	88.7
Am. coot	458.6	300.9	141.7	235.1
Ponds	1025.0	627.6	989.1	433.9

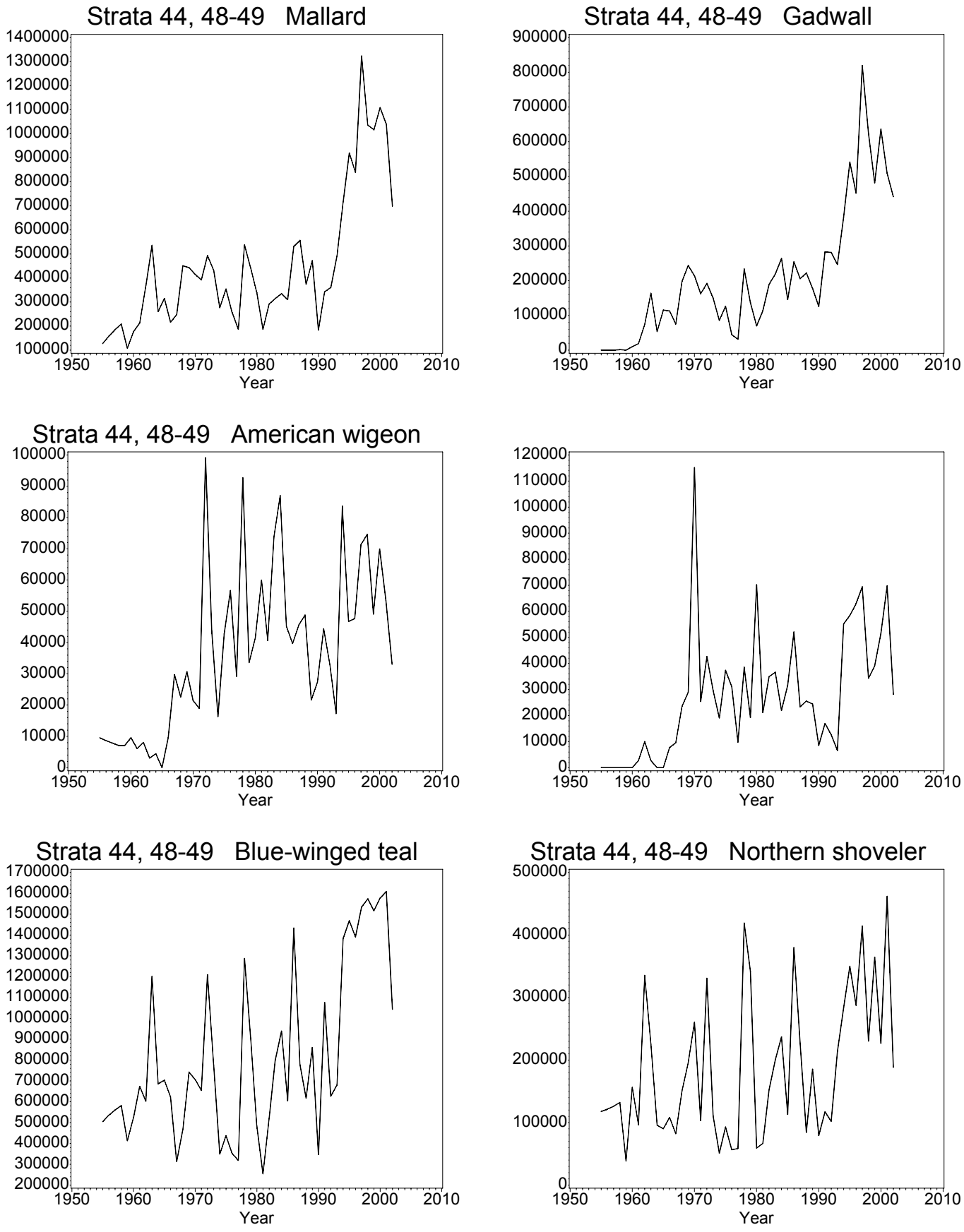
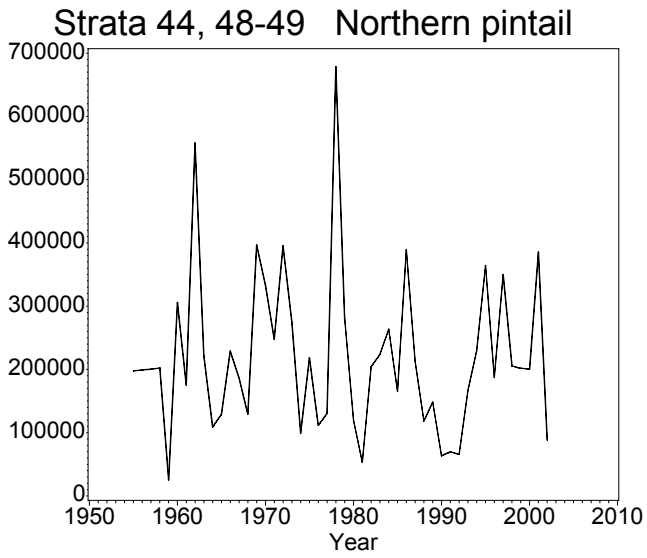
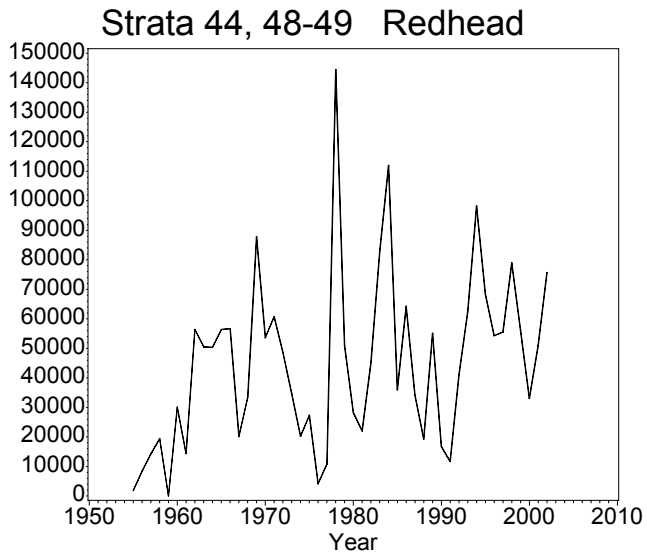
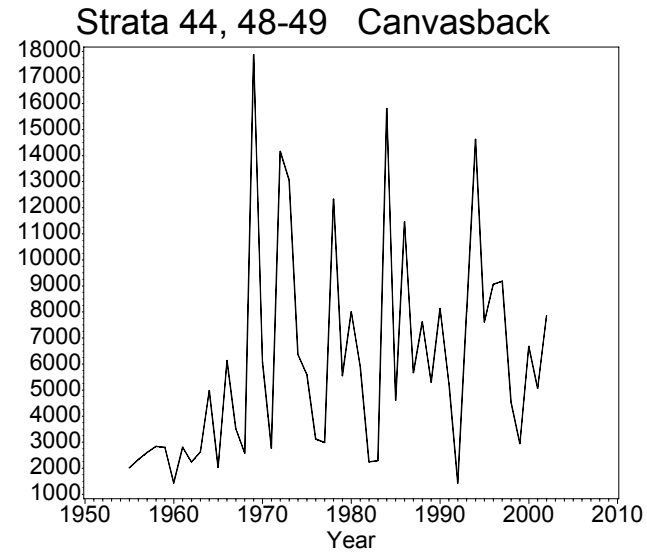
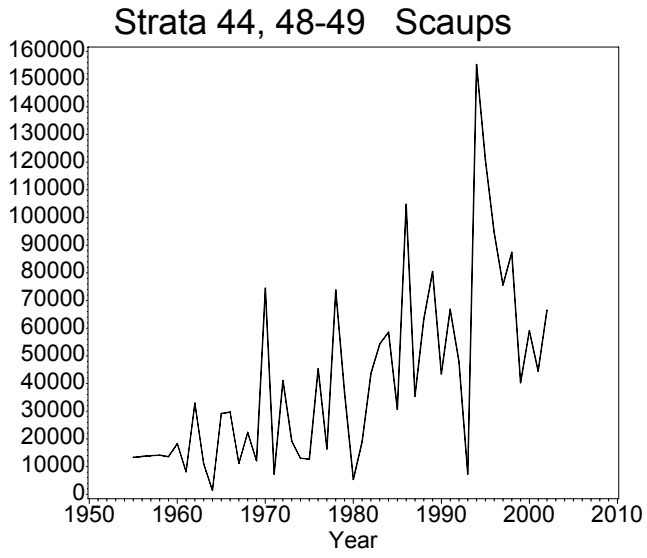


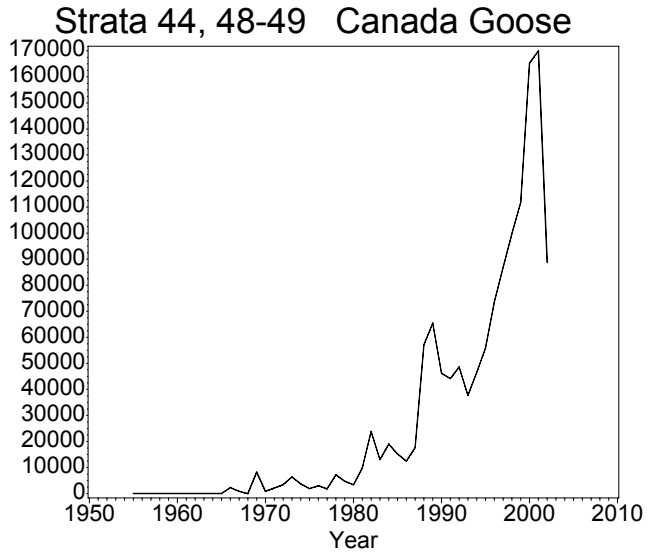
Figure 1. Population estimates for the individual waterfowl species and ponds on an annual basis.











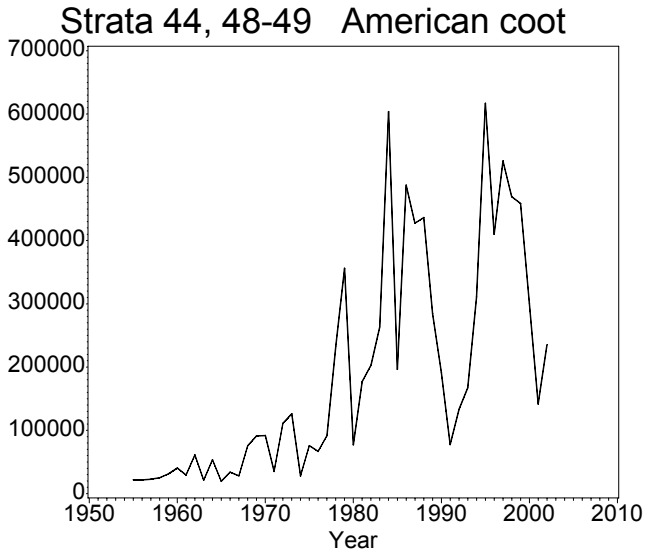
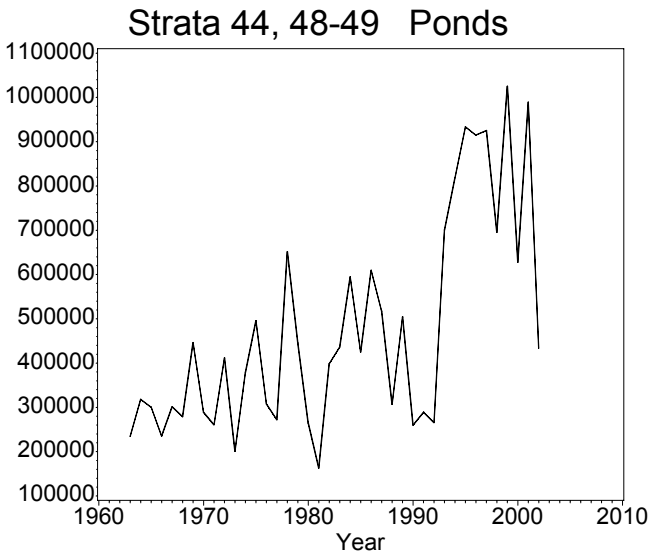


Figure 1 continued.



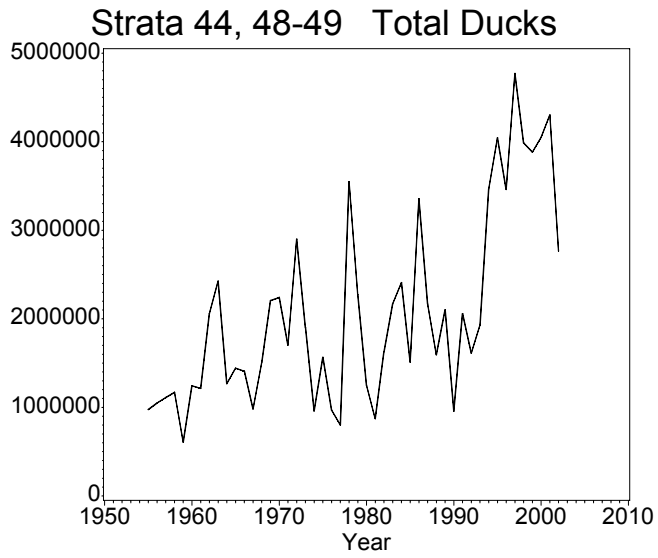


Figure 1 continued.

Table 4. Status of waterfowl breeding population estimates (thousands, adjusted for visibility bias) by species and stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean. (from1958) for North Dakota.

	Stratum								% Change From		
Species/Ponds	43	45	46	47	2002 Total	2001 Total	10-Year Mean	Long-Term Mean	2001	10-Year Mean	Long-Term Mean
Ducks											
Dabblers											
Mallard	123.4	665.3	417.0	42.1	1247.7	1484.3	1090.7	585.3	-15.9%	14.4%	113.2%
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Gadwall	49.1	388.9	248.1	5.5	691.5	780.3	743.3	361.0	-11.4%	-7.0%	91.6%
Am. wigeon	9.6	58.3	19.7	0.0	87.5	82.5	73.4	44.3	6.1%	19.2%	97.3%
Am. green-winged teal	21.1	36.2	8.9	0.0	66.3	44.7	49.2	34.9	48.2%	34.6%	89.9%
Blue-winged teal	80.4	766.0	474.2	17.7	1338.3	1688.7	1490.5	860.5	-20.7%	-10.2%	55.5%
N. shoveler	43.2	225.4	106.4	3.8	378.8	682.5	474.2	272.9	-44.5%	-20.1%	38.8%
N. pintail	29.8	132.1	65.8	0.0	227.7	377.0	318.9	345.9	-39.6%	-28.6%	-34.2%
Subtotal	356.6	2272.1	1340.0	69.2	4037.9	5140.0	4240.3	2504.8	-21.4%	-4.8%	61.2%
Divers											
Redhead	5.0	87.9	50.6	0.0	143.5	226.4	214.8	137.0	-36.6%	-33.2%	4.7%
Canvasback	2.7	22.0	7.7	0.0	32.5	66.5	44.2	29.8	-51.1%	-26.5%	9.2%
Scaups	18.6	66.9	51.4	0.0	136.8	130.3	106.2	68.5	5.0%	28.8%	99.6%
Ring-necked duck	3.1	8.4	11.2	0.0	22.8	13.3	14.1	8.0	71.3%	61.3%	184.3%
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	--	-100.0%	-100.0%
Bufflehead	0.0	1.8	0.6	0.0	2.4	5.2	2.8	1.3	-54.1%	-13.5%	80.6%
Ruddy Duck	11.3	130.4	50.8	0.0	192.6	185.0	125.9	91.3	4.1%	53.0%	110.9%
Subtotal	40.7	317.4	172.4	0.0	530.5	626.7	508.2	336.1	-15.4%	4.4%	57.8%
Miscellaneous											
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	-100.0%
Mergansers	0.0	0.0	0.0	0.0	0.0	0.7	1.3	0.9	-100.0%	-100.0%	-100.0%
Subtotal	0.0	0.0	0.0	0.0	0.0	0.7	1.3	0.9	-100.0%	-100.0%	-100.0%
Total Ducks	397.3	2589.5	1512.4	69.2	4568.4	5767.4	4749.7	2841.8	-20.8%	-3.8%	60.8%
Canada Goose	15.6	56.9	48.1	2.2	122.9	184.1	79.8	23.0	-33.3%	54.1%	434.5%
Am. coot	28.0	341.5	66.7	1.7	437.9	319.6	832.9	400.7	37.0%	-47.4%	9.3%
Ponds	96.4	373.7	192.5	19.9	682.5	750.2	916.5	727.5	-9.0%	-25.5%	-6.2%

Table 5. Long-term trend in adjusted May pond estimates (thousands) by stratum with comparisons against the previous year, the previous 10-year mean, and the long-term mean (from 1974) for North Dakota. Estimates prior to 1974 were not adjusted for visibility bias.

	Stratum				
Year	43	45	46	47	Total
1961	11.8	38.2	26.3	9.6	85.8
1962	25.5	132.6	97.1	17.4	272.6
1963	41.6	206.2	150.9	17.4	416.1
1964	29.4	107.2	41.4	10.4	188.5
1965	51.3	199.4	103.8	13.9	368.4
1966	55.7	265.5	182.9	36.5	540.6
1967	50.1	311.7	168.8	29.9	560.6
1968	54.0	141.1	109.9	11.7	316.8
1969	89.5	326.2	169.9	31.6	617.2
1970	101.5	473.0	152.4	29.2	756.1
1971	109.4	365.5	87.4	17.0	579.3
1972	130.9	338.2	148.0	35.3	652.4
1973	88.4	167.4	54.0	11.8	321.6
1974	64.7	950.9	179.3	57.3	1252.2
1975	104.9	703.4	286.0	41.4	1135.8
1976	84.0	505.1	221.8	37.4	848.2
1977	88.2	179.2	60.1	12.8	340.3
1978	123.7	304.2	195.2	14.2	637.3
1979	87.0	447.4	268.5	32.9	835.8
1980	65.4	179.5	89.4	11.1	345.5
1981	70.3	208.4	55.2	9.7	343.5
1982	140.5	443.2	183.4	19.0	786.0
1983	80.0	398.1	147.5	23.3	648.9
1984	113.9	554.6	269.2	27.7	965.4
1985	115.0	355.5	126.6	17.6	614.6
1986	120.0	381.2	201.7	25.8	728.8
1987	134.5	281.2	170.4	15.1	601.1
1988	94.7	135.4	74.8	8.7	313.6
1989	116.4	198.6	117.5	15.5	448.0
1990	72.8	64.9	39.5	8.0	185.2
1991	72.4	59.1	36.1	7.7	175.3
1992	119.6	146.7	47.9	9.4	323.6
1993	106.4	167.3	163.0	18.4	455.1
1994	203.2	412.0	275.5	27.9	918.7
1995	197.0	581.6	348.0	34.1	1160.6
1996	193.9	545.0	386.1	55.8	1180.7
1997	163.0	558.8	393.3	42.4	1157.6
1998	159.4	462.4	359.0	64.0	1044.8
1999	137.5	895.5	361.3	45.6	1439.9
2000	105.1	363.2	242.4	23.6	734.3
2001	86.2	414.9	222.1	26.9	750.2
2002	96.4	373.7	192.5	19.9	682.5
10-year Mean	147.1	454.7	279.9	34.8	916.5
Long-term Mean	115.0	389.2	197.2	26.2	727.5
Percent Change:					
From 2001	11.8%	-9.9%	-13.3%	-26.0%	-9.0%
From 10-year Mean	-34.5%	-17.8%	-31.2%	-42.9%	-25.5%
From Long-term Mean	-16.1%	-4.0%	-2.4%	-24.1%	-6.2%

Table 6. Survey design for North Dakota, May 2002.

	Stratum				
	43	45	46	47	Total
Survey design					
Square miles in stratum	19,835	26,625	14,238	7,821	68,519
Square miles in sample	175.5	310.5	270.0	45.0	801.0
Linear miles in sample	702	1,242	1,080	180	3,204
Number of transects in sample	5	7	8	6	26
Number of segments in sample	39	69	60	10	178
Expansion factor	113.0199	85.74879	52.73333	173.8000	---
Current year coverage					
Square miles in sample	175.5	310.5	270.0	45.0	801.0
Linear miles in sample	702	1,242	1,080	180	3,204
Number of transects in sample	5	7	8	6	26
Number of segments in sample	39	69	60	10	178
Expansion factor	113.0199	85.74879	52.73333	173.8000	---

Appendix 2. Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Ducks										
Dabblers										
Mallard	402.4	162.2	288.5	225.9	238.1	512.8	271.1	430.2	507.1	545.0
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	44.8	13.4	85.2	56.4	156.2	213.8	86.0	226.8	269.5	216.2
Am. wigeon	24.7	24.9	22.8	5.0	3.8	16.4	4.6	5.9	18.6	27.9
Am. green-winged teal	4.5	0.0	0.0	6.8	0.0	2.2	0.0	3.3	60.9	26.9
Blue-winged teal	528.7	316.4	519.5	295.6	755.2	686.6	584.5	913.5	1041.7	1106.1
N. shoveler	62.9	45.3	184.8	106.8	271.5	221.0	102.8	289.4	290.4	403.8
N. pintail	330.4	62.8	632.7	244.9	429.6	320.7	230.3	478.6	495.3	544.9
Subtotal	1398.3	625.0	1733.4	941.4	1854.5	1973.5	1279.2	2347.6	2683.5	2870.8
Divers										
Redhead	34.1	15.3	88.9	39.3	91.2	97.4	58.5	117.1	203.1	163.1
Canvasback	30.7	6.9	13.2	3.1	2.2	14.7	17.2	19.0	53.6	26.5
Scaups	11.7	22.1	40.7	18.3	77.7	15.1	3.0	14.0	15.5	22.1
Ring-necked duck	0.0	0.0	2.9	0.0	0.0	0.9	0.0	0.0	2.5	0.0
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Bufflehead	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
Ruddy Duck	1.6	23.8	44.3	23.3	27.5	18.2	5.4	9.0	33.4	41.8
Subtotal	78.1	68.1	190.0	84.0	198.6	146.3	84.1	159.3	309.4	253.6
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0
Subtotal	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.2	0.0
Total Ducks	1476.4	693.1	1923.4	1025.5	2053.1	2120.0	1363.3	2507.2	2993.2	3124.4
Canada Goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Am. coot	59.0	94.4	82.0	51.1	104.0	47.4	14.2	93.8	150.5	203.3
Ponds										

Species/Ponds	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Ducks										
Dabblers										
Mallard	434.6	462.6	736.6	769.3	674.0	547.2	458.4	566.5	368.0	292.1
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	352.9	323.1	373.9	372.2	353.6	223.2	213.6	330.1	76.5	103.0
Am. wigeon	8.3	40.5	30.0	28.1	29.1	36.0	44.1	72.8	62.3	31.7
Am. green-winged teal	12.4	67.0	138.6	23.4	51.0	38.0	75.0	59.4	17.4	7.4
Blue-winged teal	749.7	902.9	712.7	1238.1	780.3	588.7	1171.3	1051.4	357.0	282.2
N. shoveler	194.8	304.0	454.9	219.4	289.9	129.7	219.5	225.2	89.7	71.2
N. pintail	169.4	693.7	831.6	690.0	749.1	257.1	487.1	455.6	208.6	91.1
Subtotal	1922.2	2793.9	3278.5	3340.4	2926.9	1819.9	2669.0	2761.1	1179.5	878.6
Divers										
Redhead	93.3	177.1	153.5	123.7	126.9	94.6	110.7	214.8	63.6	31.9
Canvasback	17.3	58.9	24.7	14.7	30.2	28.5	63.0	39.3	15.3	10.3
Scaups	16.6	36.3	28.3	28.2	30.4	41.9	37.3	70.3	54.1	19.7
Ring-necked duck	0.0	0.6	2.8	1.1	0.7	0.0	0.6	1.2	1.1	1.4
Goldeneyes	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Bufflehead	0.0	0.0	1.8	0.0	2.6	0.5	0.0	0.0	0.7	0.0
Ruddy Duck	15.5	45.2	86.0	47.0	55.1	40.7	167.0	125.1	22.8	21.1
Subtotal	142.8	318.0	297.1	214.7	247.1	206.1	378.5	450.7	157.7	84.4
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	2.9	0.0	0.0	1.4	0.7	0.7	0.0	0.0	0.0
Subtotal	0.0	2.9	0.0	0.0	1.4	0.7	0.7	0.0	0.0	0.0
Total Ducks	2065.0	3114.7	3575.6	3555.1	3175.4	2026.7	3048.2	3211.8	1337.2	963.0
Canada Goose	0.0	0.0	0.0	0.0	0.0	3.8	0.9	3.3	2.2	3.8
Am. coot	127.5	131.3	192.3	147.7	178.8	124.7	368.9	512.9	104.2	74.8
Ponds							1252.2	1135.8	848.2	340.3

Appendix 2 (continued). Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Ducks										
Dabblers										
Mallard	506.6	641.4	485.4	308.6	466.5	398.9	550.3	361.4	487.8	582.6
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	243.9	369.2	224.3	255.6	381.2	435.0	528.8	274.0	287.7	275.9
Am. wigeon	69.4	47.4	84.0	119.2	41.5	45.1	38.7	58.9	30.9	44.1
Am. green-winged teal	20.5	25.4	92.4	39.2	52.6	16.4	16.2	58.9	20.1	33.5
Blue-winged teal	737.4	826.5	888.4	252.8	906.3	545.7	861.0	547.0	871.8	579.4
N. shoveler	277.5	447.3	181.9	264.1	377.4	194.3	273.3	153.2	244.7	255.5
N. pintail	588.5	517.3	291.8	135.2	369.4	329.4	375.5	198.9	260.0	191.6
Subtotal	2443.7	2874.5	2248.2	1374.7	2594.9	1964.8	2643.7	1652.3	2202.9	1962.8
Divers										
Redhead	191.8	198.3	122.7	75.2	258.2	226.3	170.3	116.9	103.5	99.0
Canvasback	17.0	42.7	28.5	31.9	32.4	12.4	50.9	20.1	36.3	28.7
Scaups	99.8	199.2	47.7	107.5	103.9	92.6	120.8	102.1	129.4	91.4
Ring-necked duck	2.2	8.4	3.6	0.0	11.6	103.0	12.2	3.5	11.6	3.2
Goldeneyes	0.0	0.0	0.0	0.0	0.0	2.5	1.4	0.0	0.0	1.0
Bufflehead	1.0	2.4	1.4	1.0	0.7	3.7	7.1	0.5	0.8	0.0
Ruddy Duck	123.3	98.0	111.4	237.6	357.1	184.8	251.8	111.9	170.1	113.9
Subtotal	435.0	549.0	315.4	453.2	763.9	625.2	614.4	355.0	451.7	337.2
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.0	0.0	0.0	0.3	6.3	2.7	0.5	0.0	0.5
Subtotal	0.0	0.0	0.0	0.0	0.3	6.3	2.7	0.5	0.0	0.5
Total Ducks	2878.7	3423.5	2563.6	1827.9	3359.1	2596.3	3260.8	2007.8	2654.6	2300.5
Canada Goose	0.9	2.7	3.7	7.4	22.4	10.5	13.7	11.3	17.0	12.3
Am. coot	389.6	1358.1	396.0	374.7	561.3	411.0	898.9	309.7	313.2	530.3
Ponds	637.3	835.8	345.5	343.5	786.0	648.9	965.4	614.6	728.8	601.1

Species/Ponds	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ducks										
Dabblers										
Mallard	354.9	404.0	142.2	261.8	364.1	374.1	900.7	1063.9	1100.5	1377.7
Am. black duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gadwall	294.9	296.3	296.0	197.9	388.7	285.8	433.3	757.4	806.3	893.8
Am. wigeon	40.8	15.6	22.9	20.9	44.1	13.9	71.4	92.0	78.9	83.2
Am. green-winged teal	28.3	9.5	26.7	9.1	14.1	9.0	60.5	45.9	90.6	79.0
Blue-winged teal	553.9	338.5	230.4	233.4	401.4	303.1	1088.8	1463.1	1764.1	1544.6
N. shoveler	118.4	158.7	67.1	75.2	114.7	175.1	507.8	573.6	653.8	492.2
N. pintail	149.7	109.0	61.8	49.3	112.1	126.9	375.5	424.9	351.5	418.1
Subtotal	1541.1	1331.5	847.1	847.7	1439.2	1288.0	3438.0	4420.8	4845.8	4888.7
Divers										
Redhead	55.2	133.4	17.0	14.7	78.8	102.2	155.0	218.2	257.9	216.5
Canvasback	19.2	39.2	10.1	8.6	17.3	19.8	56.1	42.0	58.6	69.2
Scaups	83.0	38.8	43.6	89.9	23.0	36.6	109.6	108.5	91.5	115.5
Ring-necked duck	10.5	10.9	9.6	5.0	10.3	0.4	15.7	44.4	12.1	11.2
Goldeneyes	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Bufflehead	0.5	2.1	0.5	3.2	3.3	2.5	4.7	3.6	1.8	2.0
Ruddy Duck	12.6	55.3	62.5	14.0	29.5	33.9	105.6	78.6	72.8	180.2
Subtotal	181.1	279.7	143.3	135.5	162.0	195.4	447.3	495.3	494.7	594.6
Miscellaneous										
Long-tailed duck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Mergansers	0.0	0.7	4.3	3.2	0.0	0.3	0.5	1.4	0.3	0.9
Subtotal	0.0	0.7	4.3	3.7	0.0	0.3	0.5	1.4	0.3	0.9
Total Ducks	1722.2	1611.9	994.7	986.9	1601.3	1483.7	3885.8	4917.5	5340.8	5484.3
Canada Goose	18.0	34.9	26.6	18.0	32.1	21.2	40.9	55.5	51.8	69.5
Am. coot	429.1	246.8	161.7	58.1	84.1	113.9	608.0	1675.9	1241.9	1715.3
Ponds	313.6	448.0	185.2	175.3	323.6	455.1	918.7	1160.6	1180.7	1157.6

Appendix 2 (continued). Long-term trend in adjusted waterfowl breeding population estimates (thousands) in North Dakota.

Species/Ponds	1998	1999	2000	2001	2002
Ducks					
Dabblers					
Mallard	1267.7	1490.9	1482.8	1484.3	1247.7
Am. black duck	0.0	0.0	0.0	0.0	0.0
Gadwall	932.9	918.4	1236.3	780.3	691.5
Am. wigeon	101.0	69.1	98.0	82.5	87.5
Am. green-winged teal	48.4	55.5	44.4	44.7	66.3
Blue-winged teal	1734.6	2068.0	2848.5	1688.7	1338.3
N. shoveler	360.6	535.0	647.0	682.5	378.8
N. pintail	281.2	459.1	262.8	377.0	227.7
Subtotal	4726.4	5596.1	6619.8	5140.0	4037.9
Divers					
Redhead	327.6	259.8	306.1	226.4	143.5
Canvasback	49.4	42.3	20.8	66.5	32.5
Scaups	148.0	120.8	178.2	130.3	136.8
Ring-necked duck	7.0	20.6	6.2	13.3	22.8
Goldeneyes	0.0	0.0	1.3	0.0	0.0
Bufflehead	1.1	0.3	3.2	5.2	2.4
Ruddy Duck	143.3	217.3	212.3	185.0	192.6
Subtotal	676.4	661.0	728.1	626.7	530.5
Miscellaneous					
Long-tailed duck	0.0	0.0	0.0	0.0	0.0
Eiders	0.0	0.0	0.0	0.0	0.0
Scoters	0.0	0.0	0.0	0.0	0.0
Mergansers	0.5	0.7	7.5	0.7	0.0
Subtotal	0.5	0.7	7.5	0.7	0.0
Total Ducks	5403.3	6257.9	7355.4	5767.4	4568.4
Canada Goose	76.5	104.5	161.6	184.1	122.9
Am. coot	767.9	889.9	912.6	319.6	437.9
Ponds	1044.8	1439.9	734.3	750.2	682.5

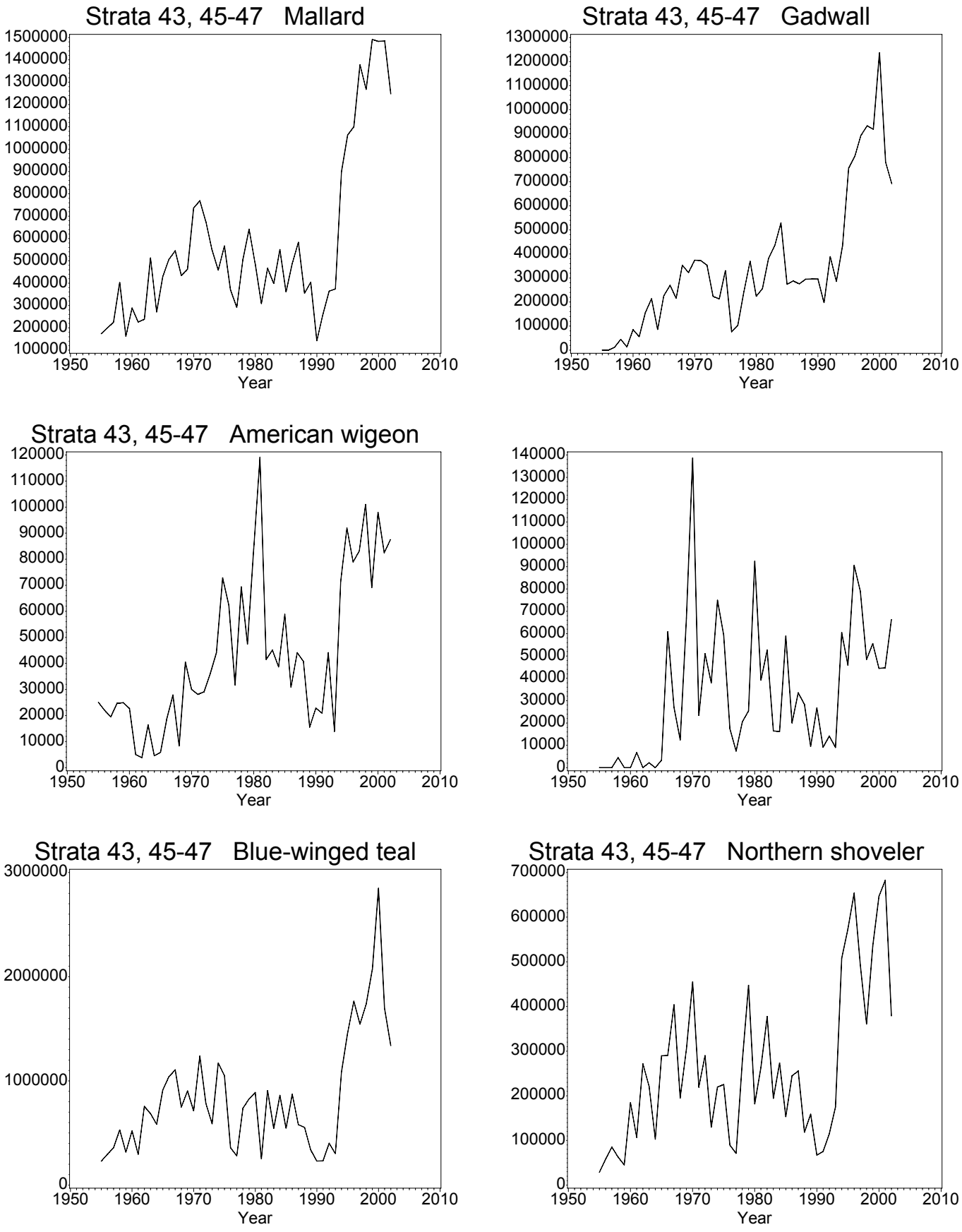
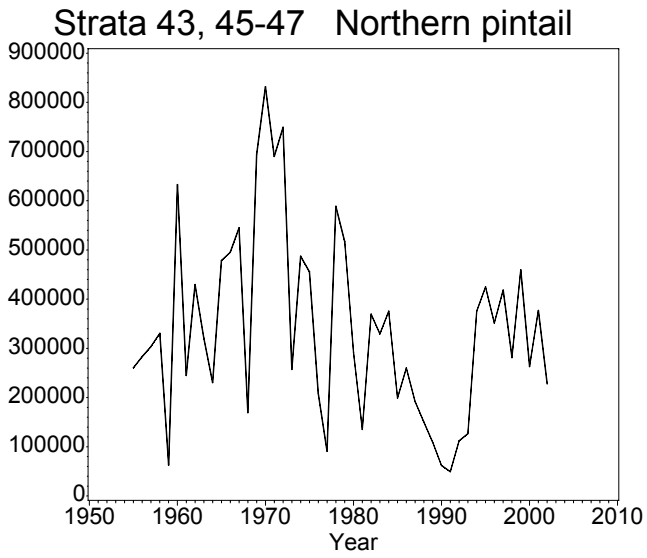
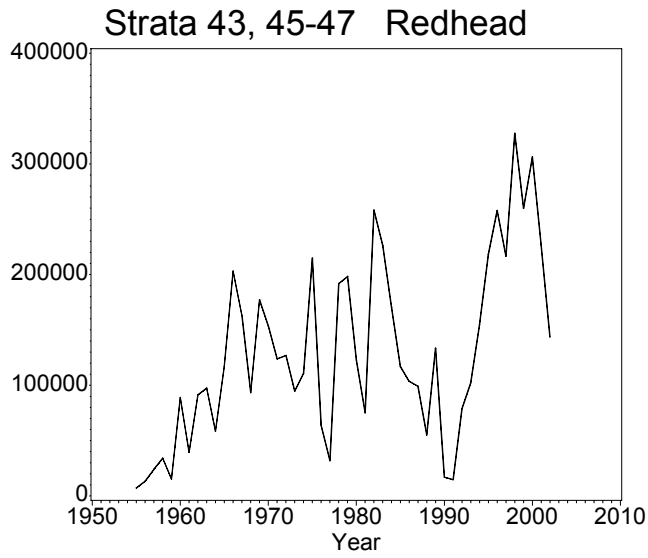
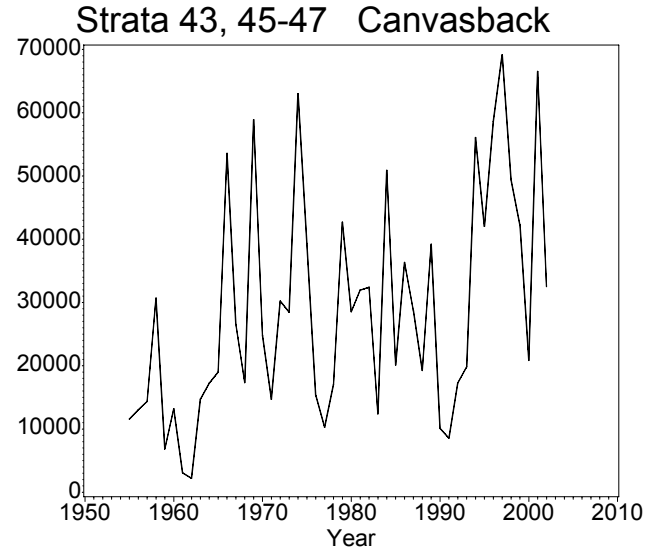
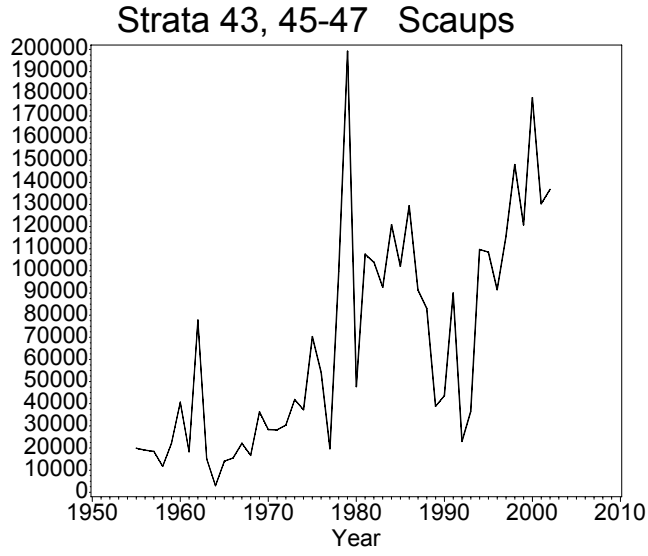


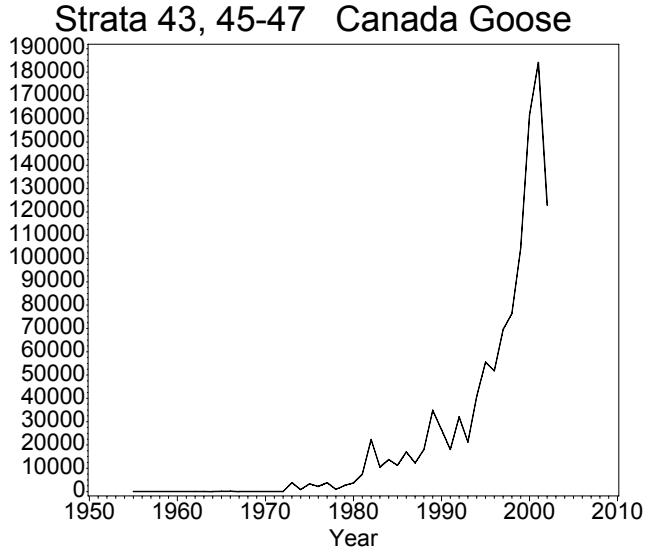
Figure 2. Population estimates for the individual waterfowl species and ponds on an annual basis.











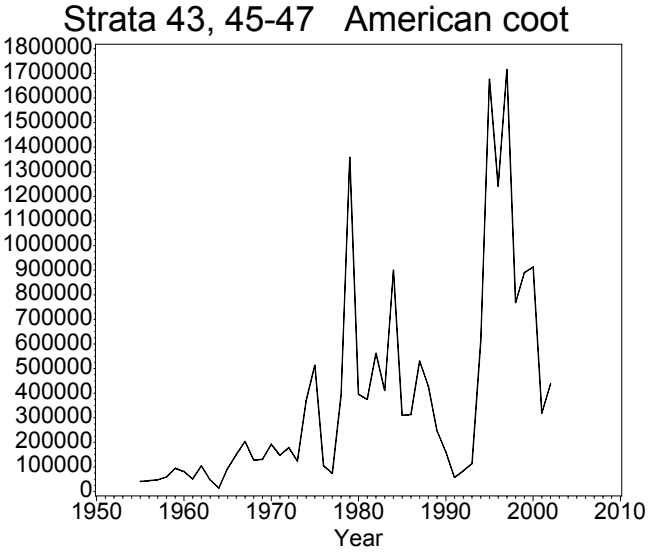
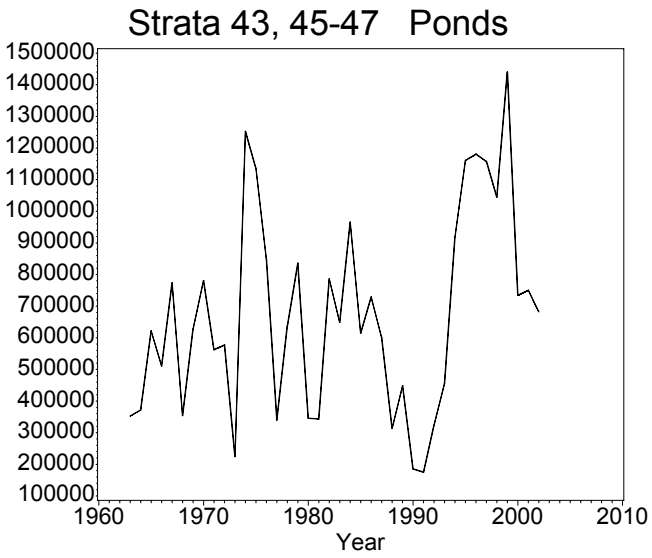


Figure 2 continued.



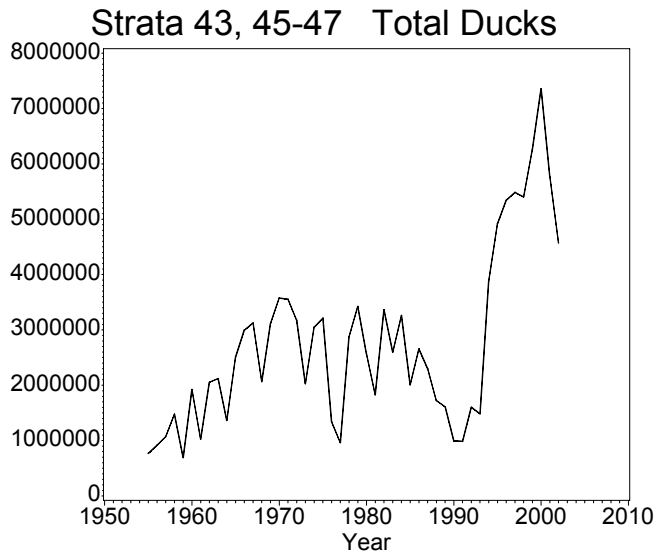


Figure 2 continued.